Space Weather Technical Forecast

Issued on Saturday, 07 May 2022 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of R1/R2 radio blackouts. Slight Chance of R3.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with GOES16 recording frequent C-class activity. There are currently three numbered sunspot regions on the visible disc, as AR3003 has recently faded from view. AR3004 is classified as Dhc/beta-gamma-delta, and produced the largest flare of the past 24 hours, a C4 at 06/1622 UTC. AR3006 is currently classified as Dai/beta-delta. AR3001 remains a Hsx/alpha. The C-class flares were produced mainly by AR3004 and also AR3006, but some also were emitted from a small plage area in the northwest quadrant. There are also numerous filaments on the visible disc.
At present then, there are no Earth-directed Coronal Mass Ejections (CMEs) in available satellite imagery.

Solar Wind / Geomagnetic Activity: The solar wind followed a slow regime, with the solar wind speed at ACE generally between 300-400 km/s, peaking at 06/0338 UTC at 445 km/s. The solar wind density was similarly unremarkable in low single-figures ppcc, while the IMF was steady at or below 5nT, with a north-south component of +1/-4nT. The phi angle remained negative (towards the Sun). The resulting geomagnetic activity was Quiet throughout (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels through the last 24 hours.
The high energy electron flux has varied between Moderate and High levels, reaching a peak of 1354 pfu at 06/1620 UTC. Electron fluence initially increased but later in the day started to decline, with the 07/0001 UTC observed 24-hour integrated value being 6.12e7pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of M-class flares from AR3004 or AR3006, with a daily Slight Chance of X-class as both regions will remain on the visible disc throughout the forecast period. A new and potentially active region appears likely to rotate onto the southeast limb within the next day or two.

Solar Wind / Geomagnetic Activity: No coronal holes feature in this forecast. Reanalysis of a centre-disc disturbance from the vicinity of AR3004 at 1700UTC on 03 May has resulted in a low confidence CME with an Earth-bound component. The CME's may arrive later today, but more likely early tomorrow. There is a Chance of Minor Storm/G1 (Kp 5) from this event, otherwise geomagnetism should remain predominantly Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is at Background levels, and is expected to continue at this level through the period. There is a daily Slight Chance of S1 or above, largely as a result of AR3004's westward advance.

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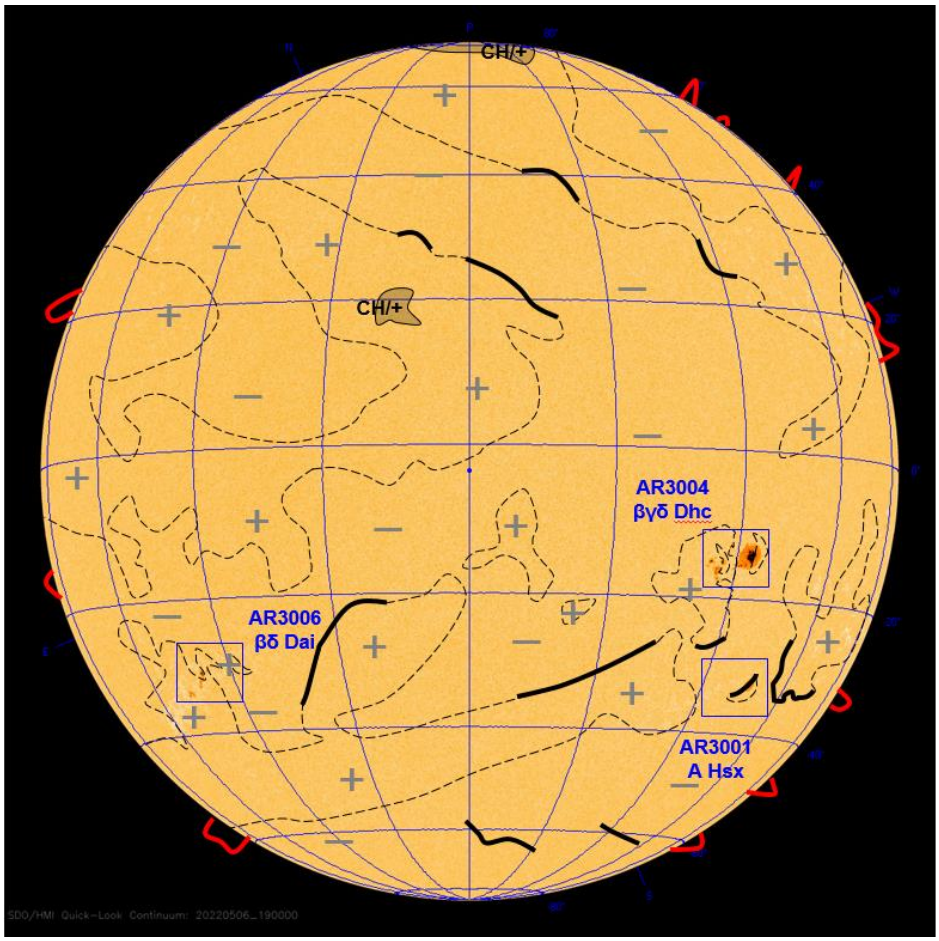
Met Office Space Weather Technical Forecast

The high energy electron flux (greater than 2MeV) is forecast to remain at predominantly Moderate levels, but breaching the High threshold (1000 pfu) at the peak of its diurnal oscillation today. Thereafter a decline in the flux is expected, especially if geomagnetic activity increases with a CME arrival. Therefore the fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 06/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

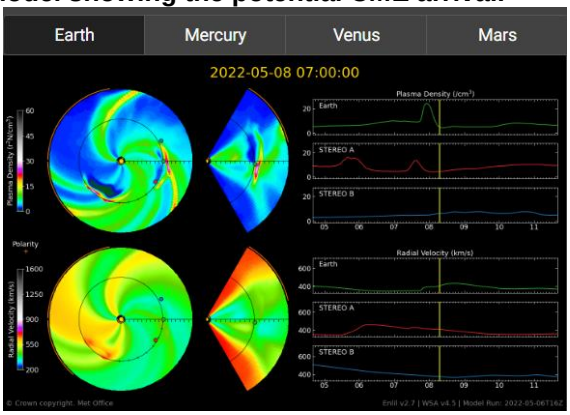
No coronal holes feature in this forecast period, and the only potential disruption to an otherwise slow solar wind regime and Quiet outlook is a low confidence CME arrival.
The CME stems from a re-analysis of a centre-disc dimming (e.g. in AIA171) in the vicinity of AR3004 on 03 May at 1700UTC. Resulting coronagraph imagery was patchy, but the bulk of the ejecta appears to be angled above and behind the Earth in the track of its orbit. Despite this, there appears to be a likely Earth-bound component, not least because of its central emission location.
The latest MOSWOC Enlil run puts arrival of this CME late today, with effects probably ongoing into tomorrow before declining to Quiet once again. Confidence is low, due to the diffuse nature of the ejecta, the slow speed of transit and the lack of an obvious accompanying flare on emission. Therefore only a chance of a Minor Storm/G1 is given, if the CME reaches Earth at all.
MOSWOC Enlil current offers a rogue speed increase into 08 May that is not expected to occur (for lack of coronal hole fast winds), however this should have minimal effect on the CME.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	40	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
04.0552 UTC	Partial	Vicinity of AR3004	NE quadrant	407 km/s	Late 7th/early 8th	Low confidence

Figure 2: Met Office ENLIL model showing the potential CME arrival.



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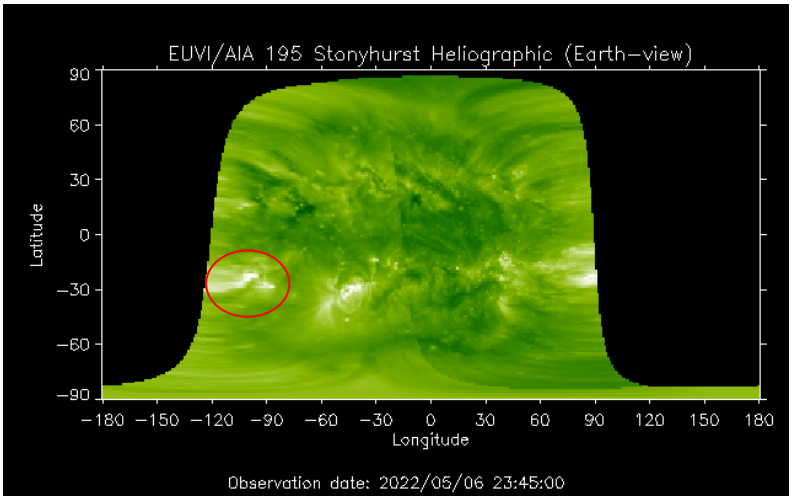
Radio Blackouts - X-Ray Flares:

There are currently three numbered sunspot regions on the visible disc, as AR3003 has recently faded from view. AR3004 has shown some fading in its intermediate spots, and also a slight reduction in length, while its leading spot remains symmetrical with a small delta spot. AR3004 produced the largest flare of the past 24 hours, a C4 at 06/1622 UTC. AR3006 trailing and intermediate spots have gown a little in area, while consolidating to a slightly lower number of spots. A small delta spot persists. AR3001 remains a small, simple and stable group. The C-class flares were produced mainly by AR3004 and also AR3006, but some also were emitted from a small plage area in the northwest quadrant. As neither AR3004 nor AR3006 rotate off the visible disc during the forecast period, so the probabilities of significant flares remains stable through the forecast period, and relatively high, despite the recent Low flare activity. The probabilities issued reflect the presence of two regions with delta spots.

A potentially significant region may rotate onto the southeast limb this weekend, leading to the chance of increased x-ray activity towards the end of the forecast period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: SDO EUVI/AIA 195 image showing a potential region, currently on the far side.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at Background levels, and is most likely to remain so through the next four days.
There is a daily Slight Chance of S1 or above, largely as a result of AR3004's approach towards the western limb over the forecast period, although it does not have a history of producing any proton response at GOES16, despite a history of M-class flares.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is forecast to continue between Moderate and High in its diurnal oscillation, but with a gradual slight decline in fluence through the period in the unsupportive current solar wind environment.
A daily Chance of Active fluence (1e8 integrated flux) should therefore fall with time, especially with potential significant geomagnetic activity occurring in the wake of any CME late today and into tomorrow. The latest MOSWOC REFM is therefore considered to be offering good guidance in keeping the fluence below the Active threshold, and with a declining trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	30	10	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Met Office REFM. ***NOTE: The REFM model has been upgraded and has changed in appearance. The two main changes are the option to include a recurrence graph, and the cadence of***

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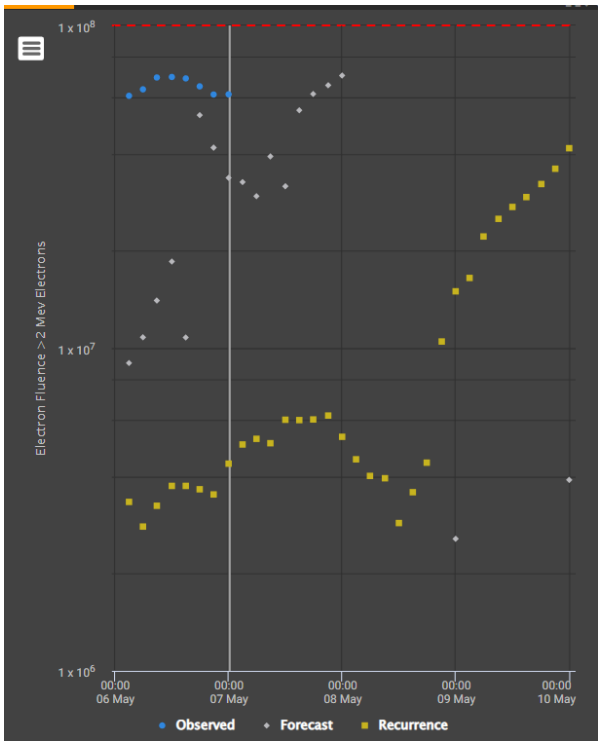
REFM forecast fluence data has been reduced past day 1 to only one value per day. The cadence remains 3-hourly for the first 24 hours.



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